Omar Alhussein

Ottawa, Ontario
Canada
+1 (226) 600 0992
oalhusse@gmail.com
omarsababha.github.io/omaralhussein/index.html

Education

Jan2016 - Apr2020 **PhD in Communications and Information Systems (Electrical and Computer Engineering)**, University of Waterloo, ON, Canada
Thesis: On the Orchestration and Provisioning of NFV-enabled Multicast Services
Advised by: Weihua Zhuang
GPA: *89/100*
Notable courses: Stochastic processes, Intro to optimization, Wireless commun. networks.

May2014 - Aug2015 **MASc in Engineering Science**,
Simon Fraser University, BC, Canada
Thesis: Performance Analysis of Wireless Fading Channels: A Unified Approach
Advised by: Jie Liang, and Sami Muhaidat
GPA: *4.22/4.33*
Notable courses: Machine learning, Linear systems theory, Advanced digital communications.

Sep2008 - Aug2013 **BSc in Telecommunication Engineering**,
Khalifa University, Abu Dhabi, United Arab Emirates
GPA: *3.53/4.0* .

Research Interests

Applied Research

Network service and management, wireless networking and protocol design
mobile-edge and cloud computing, wireless communications.

Theoritical Research

Distributed learning, information-bottleneck theory, multi-agent reinforcement learning
explainable AI, semantic communications and learning.

Work Experience

Research

Jun2020 - present **Senior Research Engineer, Advanced Networking Team**, *Huawei Technologies Canada*, Ottawa, Canada.

- Researching 6G and AI.
- Filed five patents on probabilistic and distributed AI for future networks, and on AI trustworthiness.
- One patent designated as high value patent, and another received a nomination.
- Received Quality Star Award for 2022.
- Received the highest Outstanding Individual Award for 2021.
- Received Director's Spotlight Award in Technology in April 2021.
- Received Ottawa Wireless Department Spotlight Award in August 2021.

Jan2016 - Apr2020 **Doctoral Research**, *University of Waterloo*, Waterloo, Canada.

- Developed a model-free data-driven method, using deep reinforcement learning, to compose and orchestrate abstract network services with time-varying traffic requirements onto the network substrate. A main result is using model-based solution with a vanilla DRL aids in the exploration process especially in conflicting and sparse reward environments.
- Developed an online competitive algorithm for multicast services with mandatory and best-effort NFs. The algorithm is designed using a primal-dual based approach, and it offers generalized and alternative description to existing relevant works. Results published in IEEE JSAC.
- Formulated an optimal joint traffic routing and NF placement for multicast services. Developed heuristic algorithm to decrease the complexity of the NP-hard problem. Published in IEEE JSAC and Globecom.
- Link to thesis: http://hdl.handle.net/10012/15850

May2014 - Aug2015 **MASc Research**, *Simon Fraser University*, Vancouver, Canada.

- Adopted two tractable mixture distributions, namely mixture of Gaussian and mixture of Gamma, to approximate various (composite) fading channels using the expectation-maximization and variational Bayes algorithms.
- Conducted performance analyses over various composite fading channels (using the mixture distributions) in several environments, such as cognitive radio networks, and impulsive noise environments.
- Results were published in seven conf/journal papers.
- Link to thesis: http://summit.sfu.ca/item/15696

Dec2013 - May2014 **Research Assistant**, *Etisalat British Telecom Innovation Centre*, Abu Dhabi.

- Developed a data reduction pre-processing technique for large datasets to be used in machine learning classifiers. Several papers were published. Was advised by Paul. D. Yoo & Kin Poon.

Teaching

Jan2018 - May2019 **Graduate Teacher Assistant**, *University of Waterloo*,
Digital communications (ECE 318), and Communication networks (ECE 358).

Jan2015 - May2015 **Graduate Teacher Assistant**, *Simon Fraser University*,
Introduction to engineering analysis (ENSC 180), and linear systems (ENSC 380).

Jan2010 - May2012 **Science Communicator (part-time)**, *Khalifa University Intel Discovery Center*, Abu Dhabi.
Presented computing and communication technologies to stimulate/inspire school kids.

May2009 - Jun2009 **Teacher assistant and supervisor**, *Institute of Applied Technology*, Abu Dhabi.
Served as a teacher assistant and supervisor in a summer school for primary school students.

Other

Jun2012 - Nov2012 **Internship**, *ELKO TGS*, Ankara, Turkey.
Worked on the feasibility of initiating a SCADA communication system for the company. Through vulnerability assesment analysis, I was able to hack into R&D systems and sensitive control machines. Tasks included optimizing company's network and its security.

Jan2010 - May2013 **Supervisor/invigilator (part-time)**, *IETLS Outreach Centre, British Council*, UAE.
Particpated in a mobile team to carry IELTS examinations in different places. Started off as a marshal and was promoted to invigilator and then supervisor in very short-time.

Current Supervision

Sep 2021 - present Zaid Almahmoud, Deep Learning based Reconnaissance Techniques for Cyber Events, persuing Ph.D. at Birkbeck College, University of London. Co-supervision with Paul D. Yoo.

Patents

6G, distributed ML **O. Alhussein**, A. Akhavain, Communication-efficient training method for wireless split learning based network functions, *allowed internally - filing process*.

networking, distributed ML **O. Alhussein**, M. Bhatti, and A. Akhavain, Adaptive encoding and decoding of information for network functions, Patent Corporation Treaty (PCT) Application 92012899PCT01, Nov. 18, 2022. *Nominated as high value patent.*

traffic engineering, distributed ML **O. Alhussein**, Distributed network encoder-decoder system and method for traffic engineering, *United States Patent Application 92008480US01, Nov. 18, 2022.*

traffic engineering, Bayesian DL **O. Alhussein**, and A. Akhavain, Methods and Apparatus for Managing Network Traffic Via Uncertainty, United States Patent Application 17/568,893, Jan. 5, 2022.

DRL, privacy, AI Trustworthiness **O. Alhussein**, and P. Ashwood-smith, Methods, Systems, and Computer Program Products for Protecting a Deep Reinforcement Learning Agent, United States Patent Application 17/546,768, Sep. 12, 2021. *Designated as high-value patent.*

Note: Some patents will be published as conference/journal papers in 2023.

Manuscripts under review

cyber security, AI Z. Almahmoud, Paul D. Yoo, and **O. Alhussein**, A holistic and proactive approach to forecasting cyber threats, *submitted to Nature Communications*.

Peer-reviewed Publications

NFV, DRL — **O. Alhussein**, and W. Zhuang, "Dynamic Topology Design of NFV-enabled Services using deep Reinforcement learning," IEEE Transactions on Cognitive Communications and Networking, to appear. DOI: 10.1109/TCCN.2021.3139632

performance analysis — M. Li, S. Huang, L. Tian, **O. Alhussein** and S. Muhaidat, "Error rate performance of NOMA system with full-duplex cooperative relaying," Physical Comm., pp. 1-1, 2021.

trust management, network security — M. Ben-Yahya, **O. Alhussein**, and X. Shen, "Securing software-defined WSNs Communication via trust Management," IEEE Internet of Things J., pp. 1–1, 2021.

NFV, online algorithms — **O. Alhussein**, and W. Zhuang, "Robust online composition, routing and NF placement for NFV-enabled services," IEEE J. Sel. Areas Commun., vol. 38, no. 6, pp. 1089–1101, 2020.

NFV, multicast routing — **O. Alhussein**, P. T. Do, J. Li, W. Shi, W. Zhuang, and X. Shen, "A Virtual network customization framework for multicast services in NFV-Enabled core networks," IEEE J. Sel. Areas Commun., vol. 38, no. 6, pp. 1025–1039, 2020.

ML, subsampling — **O. Alhussein**, P. D. Yoo, S. Muhaidat, J. Liang, "Efficient subsampling framework of very large datasets in machine learning," in Proc. IEEE CCECE, 2019, pp. 1-6.

spectrum sensing — M. Li, **O. Alhussein**, P. Sofotasios, S. Muhaidat, P. D. Yoo, J. Liang, and A. Wang, "Censor-based cooperative multi-antenna spectrum sensing with imperfect reporting channels," IEEE Trans. Sustainable Comput., vol. 05, no. 01, pp. 48-60, 2019.

NFV, multicast routing — **O. Alhussein**, P. T. Do, J. Li, Q. Ye, W. Shi, W. Zhuang, X. Shen, X. Li, and J. Rao "Joint VNF placement and multicast traffic routing in 5G core networks," in Proc. IEEE GLOBECOM, 2018, pp. 1-6.

mixture distributions, algorithms — M. Wahbah, **O. Alhussein**, et al., "Evaluation of parametric statistical models for wind speed probability density estimation," in IEEE Proc. EPEC, 2018, pp. 1-6.

SDN, space-air-ground networks — N. Zhang, S. Zhang, P. Yang, **O. Alhussein**, W. Zhuang, and X. Shen, "Software defined space-air-ground integrated vehicular networks: Challenges and solutions," IEEE Comm. Magazine, vol. 55, no. 7, pp. 101–109, 2017.

impulsive noise, generalized fading — **O. Alhussein**, I. Ahmed, J. Liang, S. Muhaidat. "Unified analysis of diversity reception in the presence of impulsive noise," IEEE Trans. Vehicul. Technol., vol. 66, no. 2, pp. 1408–1417, 2017.

cooperative spectrum sensing — A. Al Hammadi,**O. Alhussein**, P. C. Sofotasios, S. Muhaidat, M. Al- Qutayri, S. Al-Araji, G. K. Karagiannidis, and J. Liang, "Unified Analysis of cooperative spectrum sensing over composite and generalized fading channels," IEEE Trans. Vehicul. Techn., vol. 65, no. 9, pp. 6949–6961, 2016.

ML, intrusion detection — O. Al-Jarrah, **O. Alhussein**, P. D. Yoo, S. Muhaidat, K. Taha, and K. Kim, "Data randomization and cluster-based partitioning for botnet intrusion detection," IEEE Tran. Cybern., vol. 46, no. 8, pp. 1796–1806, 2016.

approximation techniques, performance analysis — B. Selim, **O. Alhussein**, S. Muhaidat, G. K. Karagiannidis, and J. Liang, "Modeling and analysis of wireless channels via the mixture of gaussian distribution," IEEE Trans. Vehicul. Techn., vol. 65, no. 10, pp. 8309–8321, 2016.

ML, security — R. Baiad, **O. Alhussein**, H. Otrok, and S. Muhaidat, "Novel cross layer detection schemes to detect blackhole attack against QoS-OLSR protocol in VANET," Vehicular Communin., vol. 5, pp. 9–17, 2016.

Mixture gamma, diversity analysis — **O. Alhussein**, A. Hammadi, P. C. Sofotasios, S. Muhaidat, J. Liang, M. Alqutayri, G. K. Karagiannidis, "Performance analysis of energy detection over mixture gamma based fading channels with diversity reception," in Proc. IEEE Wimob, 2015, pp. 399–405.

ML — F. Adly, **O. Alhussein**, P. D. Yoo, S. Muhaidat, and Y. Al-Hammadi, "Simplified subspaced regression network for identification of defect patterns in semiconductor wafer maps," IEEE Trans. Ind. Informat., vol. 11, no. 6, pp. 1267–1276, 2015.

mixture Gaussian model — **O. Alhussein**, B. Selim, T. Assaf, S. Muhaidat, G. K. Karagiannidis, and J. Liang, "A generalized mixture of gaussians for fading channels," In Proc. IEEE VTC, 2015, pp. 1–6.

spectrum sensing, fading — B. Selim, **O. Alhussein**, G. K. Karagiannidis, and S. Muhaidat, "Optimal cooperative spectrum sensing over composite fading channels," in Proc. IEEE ICC, 2015, pp. 520–525.

EM, fading — **O. Alhussein**, S. Muhaidat, J. Liang, and P. D. Yoo, "A unified approach for representing wireless channels using EM-based finite mixture of gamma distributions," in Proc. Globecom Workshops, 2014, pp. 1008–1013.

OFDM, SDR — **O. Alhussein**, R. Mahmoud, K. Eledlebi, and Z. Sead, "Spectrum sensing techniques for OFDM-based cognitive radio networks," in Terena Netw. Conf., 2013, *Indexed poster*.

ML K. Alromaithi, **O. Alhussein**, and P. D. Yoo, "An intelligent system for protein structure prediction," in Undergraduate Research Conf. Applied Comput., Zayed University, 2012, *Poster*.

S. Azzeh, **O. Alhussain**, and S. A. Abusamra, "A mathematical model to decrease obesity in the UAE," in Proc. ASME IMECE, 2011, pp. 385-390.

Technical Skills

Sim. & Math	Tensorflow, Matlab, Mathematica, R, Propsim F32, Weka
Programming	Python, C++, Git
Networking	Mininet, Kubernetes, Wireshark, NMAP, OpenFlow

Pedagogical Training

May2021 - Sep2021	Passed an online course from the University of Hong Kong on the fundamentals of university teaching.
2019-2020	Attended six seminars at the University of Waterloo that covered various topics: (a) teaching methods, (b) effective lesson plans, (c) classroom delivery skills, (d) student's beliefs about learning, and (e) providing quality feedback.

Teaching Interests (Alphabetical)

Aritificial Intelligence, Computer Networks, Data Structures, Deep Learning, Design and Analysis of Algorithms, Machine Learning, Natural Language Processing, Network-function Virtualization, Object-oriented programming, Satellite (GEO and LEO) networks, Software-defined Networking, Wireless Networks.

Honors and Awards

2021	Awarded Outstanding Individual Award for the year 2021, Huawei Technologies Canada.
Aug2021	Awarded Wireless Department Spotlight Award in Huawei Technologies Canada, Ottawa.
Apr2021	Awarded Director Spotlight Award in Huawei Technologies Canada, Ottawa.
Sep2019	Awarded University of Waterloo Graduate Scholarship ($1500).
Sep2019	Awarded Xuemin Shen graduate scholarship in communications ($1000).
May2019	Awarded University of Waterloo Graduate Scholarship ($1500).
Jan2016	Awarded faculty of engineering graduate scholarship, University of Waterloo ($1500).
Jan2014 - Aug2015	Awarded graduate fellowship, Simon Fraser University ($6250).
Sep2008 - Aug2013	Awarded full undergraduate scholarship, Khalifa University ($172,822).
May2012	Won first place at the ASME rapid design challenge, District J. Development Conference at the Lebanese American University.
2009-2011	Represented school at gulf/national programming contests (NPC2009, NPC2010, GPC2011).
2010–2010	Won first place at university competitive programming contest, Khalifa University.
2010–2010	Won second place at the engineering design competition, IEEE-UAE Student Day.

Service

2022-present	Associate Editor for Peer-to-Peer Networking and Applications Springer Journal.
2022-2022	TPC member for Proc. IEEE VTC and Globecom
2018-2021	TPC member for Proc. IEEE CommNet.
2013-present	Regular Reviewer for IEEE Commun. Lett., IEEE Tran. Veh. Techn., IEEE Proc. Globecom, & many other journals and conferences.
2010–2012	Vice Chair, IEEE Student Chapter, Khalifa University.
2010–2011	Engineering Section Editor, Student Voice Newsletter, Khalifa University.

Other Interests

Swimming and Free-diving (Licensed AIDA-2, personal record: 3m45s static apnea).

Traveling (mostly occasional weekend escapades, and event travels).